

**PATENT APPLICATION OF**

Si-Nin Quan

Judy, Fei-Man Quan

San Jose, CA

For

**TITLE: REVOLUTIONARY CONNECTIONS FOR SPARK PLUGS**

**AND SPARK PLUG CABLES**

**FEDERALLY SPONSORED RESEARCH**

Not Applicable

**SEQUENCE LISTING OR PROGRAM**

Not Applicable

**BACKGROUND OF THE INVENTION**

**1. Field of Invention**

The present invention relates to high voltage electrical connections, and more specifically to connectors for attaching spark plug cable terminals to spark plug terminals of internal combustion engines.

## 2. Discussion of Prior Art

Many varying types of connectors have been proposed and used for making electrical connections from spark plug cable terminals to spark plug terminals. For many applications, including most automotive applications, the related art enumerated in the following provide the field with improvement by certain manner:

1. 1,245,931(Lanman)
2. 1,376,844(Weber)
3. 1,509,224 (9/1924-Berthold)
4. 1,792,866( 2/1931-Rabazzaner)
5. 1,835,000(12/1931-Berthold)
6. 1,911,395(5/1933-Rowley)
7. 1,933,304(10/1933-Bell)
8. 2,301,570(Nowosielski)
9. 2,323,399(Jacobi)
10. 2,382,805(Mosthaf)
11. 2,666,423(1/1954-Johnson Jr.)
12. 2,685,872(Berstler)
13. 2,686,511(Platner)
14. 2,904,769(9/1959-Sampson et al.)
15. 3,076,113(Candelise)
16. 3,128,139(Estes)
17. 3,223,963(12/1965-Ravey et al)
18. 3,359,526(12/1967-Bakker)
19. 3,431,534(3/1969-Schrader et al.)
20. 3,435,404(3/1969-Kato)
21. 3,803,529(4/1974-Bohrig et al.)
22. 3,845,459(Normann)
23. 3,914,003(Loy)
24. 4,145,106(3/1979-Livingston)

25. 4,443,047(Hofmann)
26. 4,497,532(2/1985-Bezusko et al.)
27. 4,614,392(Moore)
28. 4,621,881(11/1986-Johansson et al.)
29. 4,671,586(6/1987-Debolt)
30. 4,810,198(3/1989-Sturdevan)
31. 4,886,473(12/1989-Germ)
32. 4,997,380(3/1991-Etienne et al.)
33. 5,053,092(10/1991-Lachman)
34. 5,127,840(7/1992-Bezusko et al.)
35. 5,274,298(12/1993-Cassidy et al.)
36. 5,297,971(3/1994-Nitta et al.)
37. 5,332,394(7/1994-Frost)
38. 5,340,323(8/1994-Imanishi et al.)
39. 5,421,736(6/1995-Imanishi et al.)
40. 5,813,872(Evans et al.)

Yet none of the above cited references teach a solution to the original problem which is the connection itself. Apparently the existing prior art endeavor to develop improvement in one end of the connection while leaving the other end unattended. A connection, a coupling or a junction is supposed to have at least two or more components before they are so termed, it is a common practice that all the components be coordinated and matched in order to refine upon the connections. By modifying just one end without synchronizing the other usually will turn out endless effort, the design and configuration of spark plug terminals remain pretty much the same since early this century, numerous prior art contemplated a solution to the problem by only refining the spark plug cable terminals to compromise, when in fact this is not the case solving the problem.

## **SUMMARY**

Accordingly, an essential object of the present invention is to provide a construction whose electrical and mechanical contact will not diminish adversely over time as the

result of vibration and high temperature; it is a further object of the invention to prevent a false sensation that a properly seated connection has been achieved; it is yet a further object to provide an easy step for detaching connections by turning instead of twisting and pulling commonly used in the related art, while the latter exasperates the problem of difficulty; it is another advantage of the invention to provide a double interlocking relationship between components.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a view of a spark plug terminal embodiment of the present invention;  
 FIG. 2 shows a side view of the spark plug terminal shown in FIG. 1;  
 FIG. 3 is a view of a cable terminal embodiment of the present invention;  
 FIG. 3A is a partial side view of the cable terminal shown in FIG. 3;  
 FIG. 4 is a bottom view of FIG. 3;  
 FIG. 4A is a bottom view of FIG. 3A;  
 FIG. 5 shows the view of FIG. 4 having spring clip with dimples installed;  
 FIG. 5A shows the view of FIG. 4A having spring clip with dimples installed;  
 FIG. 6 is a view of the spark plug terminal and the cable terminal before full engagement, X being the distance from the spark plug terminal to the cable terminal;  
 FIG. 6A shows the relation of both said terminals after full engagement; Y being the distance from the spark plug terminal to the cable terminal;  
 FIG. 7 is a view of a second embodiment, an adaptor for conventional cable terminal;  
 FIG. 7A shows a partial side view of the adaptor shown in FIG. 7;  
 FIG. 8 is a view of the adaptor being connected to a conventional cable terminal;  
 FIG. 8A shows a partial side view of the connection shown in FIG. 8;  
 FIG. 8B is a top plan view of the spring clip being engaged to the concave cavities of the adaptor shown in FIG. 7;  
 FIG. 8C is a top plan view of the spring clip being engaged to the concave cavities of the adaptor shown in FIG. 7A;  
 FIG. 9 is a view of a conventional cable terminal; and  
 FIG. 9A shows a partial side view of the conventional cable terminal shown in FIG.

## REFERENCE NUMERALS IN DRAWINGS

10: concave cavity	12: cotter pin	14: cable terminal
16: spring clip with dimples	18: dimple	20: slot
22: thru hole for dimple	24: spark plug terminal	26: adaptor
28: conventional cable terminal		
X: distance before full engagement	Y: distance after full engagement	

## DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, the present invention relates to a connection for spark plugs and cable terminals. As shown in FIG.1 and 2, the spark plug terminal 24 has two concave cavities 10 and a cotter pin 12 built-in, cotter pin 12 can be inserted or forged in the lower portion of the spark plug terminal 24 by means commonly used in machine works, two concave cavities 10 are placed at a 180° angle apart from each other and serve as receptacle for the dimples 18 of the spring clip 16. Slots 20, lateral thru holes 22 for dimples 18 and spring clip 16 with two dimples 18 of the cable terminal 14 shown in FIGS. 3, 4 and 5 can be made by regular machine works. The adaptor 26 being an alternative embodiment serves as an inter-medium between a regular cable terminal 28 and the spark plug terminal 24 of the present invention, the advantage of the alternative embodiment is to provide a quick connection for regular cable terminal 28 and the spark plug terminal 24 without any alteration to the regular and conventional cable terminal 28 currently used.

## OPERATION

The present invention provides two steps to connect and disconnect the cable terminal 14 from the spark plug terminal 24. In FIG. 6 this is illustrated where the slots 20 of the cable terminal 14 aligns with the cotter pin 12 in the spark plug terminal 24, in Fig 6A this is illustrated where the cotter pin 12 hooks at the end of the slots 20 while the dimples 18 of the spring clip 16 engage with the concave cavities 10 in the spark plug terminal 24, this is a full-engagement position. It is apparently as Fig. 6A illustrates that the connection provides a double interlocking mechanism itself, the end of the slots 20 acts as a stopper

for the cotter pin 12 which is inserted or built in the spark plug terminal 24, while the dimples 18 of the spring clip 16 hold the cable terminal 14 in place by engaging with the concave cavities 10 in the spark plug terminal 24. The manual operation of using the present connection is relatively simple, align the slots 20 with the cotter pin 12, turn the cable terminal 14 clockwise, the slant of the slots 20 will guide the cotter pin 12 to the curved end of the slots, thus the dimples 18 of the spring clip 16 will also line up and snap fit with the concave cavities 10 of the spark plug terminal 24, meanwhile the cable terminal 14 will be lifted up slightly away from the spark plug terminal 24, the tolerance in between is only  $\pm 1$  mm, but the feedback sensation of engagement is obvious and definite, X and Y stand for the distance before and after engagement. Detachment of the connection requires reversal, turn the cable terminal 14 counterclockwise until the cotter pin 12 guided by the slant of the slots 20 stopped by the other straight end of the slots 20, pull out the cable terminal 14 to complete full detachment. One major problem arises with conventional spark plug cable systems, in that removal of conventional spark plug cable terminals from spark plug terminals is frequently difficult, in most situations of limited accessibility, mechanics often choose to yank on spark plug cables a considerable distance away from the spark plug terminals, causing fatigue to the electrical connections within the spark plug cables. The advantage of the present invention of providing double locking mechanism can be translated into anticipation of much less problem of difficulty mechanics will encounter in the related field.